

Space Weather Technical Forecast

Issued on Wednesday, 01 November 2023 at 13:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of further M-class flares throughout. Chance of Active fluence between 01-03 Nov.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is now at Moderate levels, with a peak flare a M1.1 event at 01/0626 UTC suspected to be from a region beyond the southeastern horizon. AR3474 in the southwest remains the largest region on the visible disc. It contained a very small delta spot, but this has largely faded now. AR3472 in the northwest continues to see the proliferation of its numerous small spots, but remains largely inactive. AR3473 and AR3474 near centre disc are largely unchanged and inactive. A new large region has rotated over the southeast limb, with a notable lead spot and small trailer. The region is moderately active with some C-class flaring. A further small unipolar region has rotated over the northeast limb, but has not produced any significant flares so far.

A filament eruption from the southeast quadrant around 31/2200 UTC has been analysed, with a glancing blow possible at Earth either late 04 Nov or early 05 Nov.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed at L1 continue to decline, as the high speed stream from coronal hole 66 moves towards the western limb, reaching 420-450km/s by the end of the period. Density has been below average. Total magnetic field strength, Bt, has been consistently weak, with the north-south component, Bz, also varying weakly. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet throughout.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux has varied between Moderate and High levels, with a peak of 1710 pfu at 31/1620 UTC. The associated 24-hour fluence remains just below the Active (1e8 integrated pfu) threshold, reaching 6.78e7 integrated pfu at 31/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate solar activity is expected, with a chance of further isolated M-class flares.

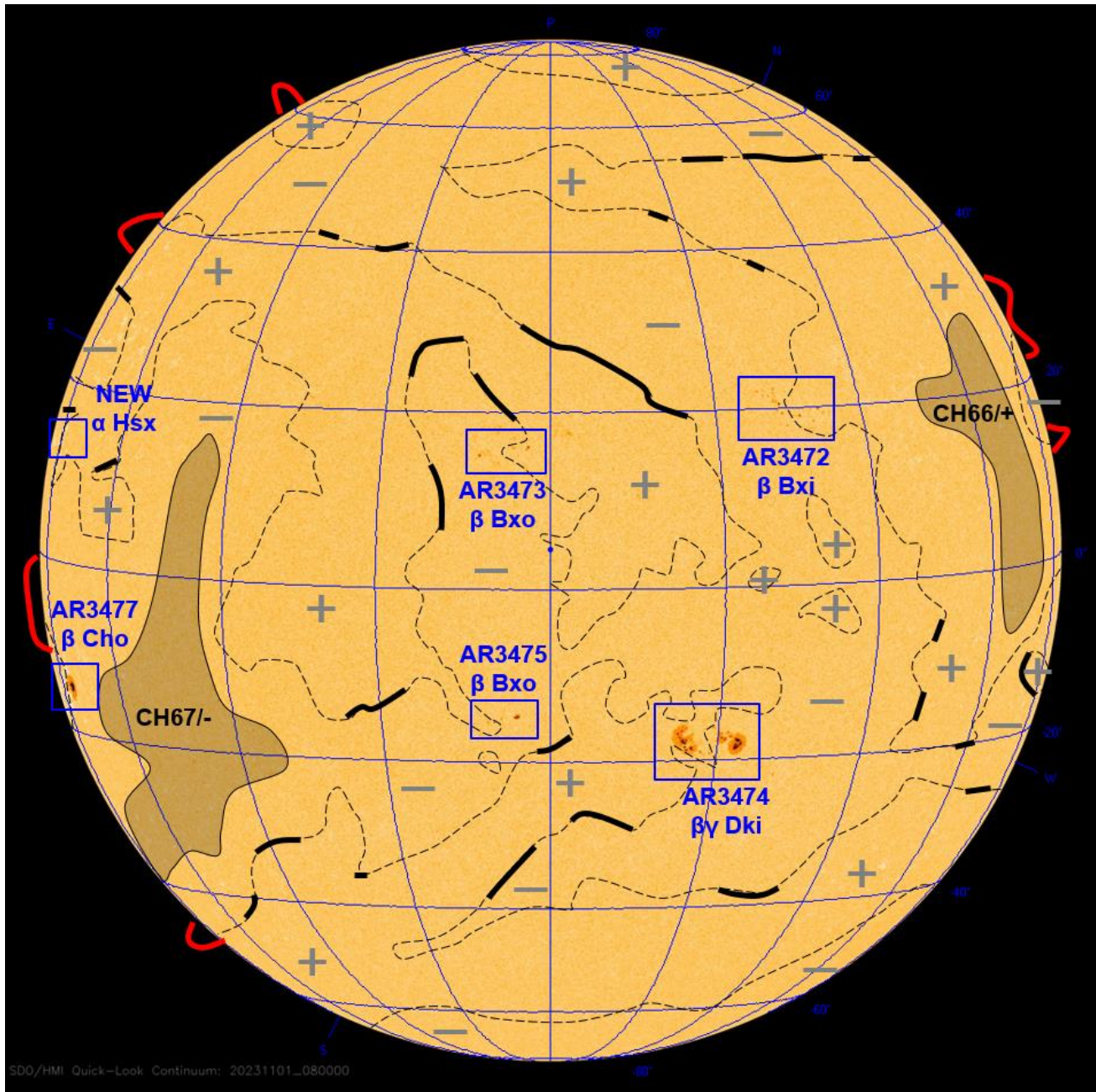
Solar Wind / Geomagnetic Activity: A CME that left the sun late in 31 Oct may give Earth a glancing blow either late day 4 (04 Nov) or early 05 Nov. Otherwise no CMEs currently feature in the forecast period. The high speed stream from coronal Hole 66 continues to slowly wane, with solar winds easing from slightly elevated levels to background in the next couple of days. No further enhancements are expected during the period. Mainly Quiet Geomagnetic activity is expected with a chance of isolated Unsettled intervals. Any potential arrival of the CME from 31 Oct could see activity increase to Unsettled to Active levels late on day 4 (04 Nov).

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels. High energy electron flux (greater than 2MeV) is forecast to oscillate between mainly Moderate and High levels in the coming days, but with a decreasing day-on-day peak. Electron fluence values remain just below the Active (greater than

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1e8 integrated pfu) threshold. There is a chance of reaching the Active threshold between days 1-3 (01-03 Nov) with the greatest likelihood of exceeding the Active threshold on day 1 (01 Nov). There is a gradual reduction in probabilities in the following days.

Figure 1. Solar Analysis Valid 01/0800 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A filament eruption from the southeast quadrant around 31/2200 UTC resulted in a CME that may give Earth a glancing blow either late day 4 (04 Nov) or early 05 Nov. No other Earth-directed CMEs presently feature in the forecast.

Solar wind speeds have declined to around 450km/s as the effects of the high speed stream from CH66/+ continue to ease. No significant transient or recurrent coronal holes are forecast to connect with Earth within the forecast period with winds expected to fall to background on day 2 (02 Nov).

Mainly Quiet Geomagnetic activity is expected with a chance of isolated Unsettled intervals. Any arrival of the CME from late 31 Oct during the latter part of day 4 (04 Nov) could see activity increase to Unsettled to Active levels.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – Nil expected

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
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Radio Blackouts - X-Ray Flares:

There are currently six sunspot regions on the visible disc. AR3474 in the southwest is the largest and most complex region, with large lead and trailer spots and some smaller intermediate spots. A weak delta spot adjacent to the asymmetric trailer spot has largely faded in recent hours. AR3477, a moderately-large region near the southeast limb is still foreshortened in available imagery, however it has been responsible for some C-class flaring in the past 24 hours. The remaining regions on the visible disc all appear small and magnetically simple at this time.

An M1.1 flare peaking at 01/0626 UTC is suspected to be from a region beyond the southeast limb. GONG farsided seismic signatures suggest a notable region lies around a day from the eastern horizon and may present an uptick in flare risk in the coming days.

Low to Moderate solar activity is forecast, with a chance of further isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels, although there is a very slight chance of proton storms from AR3474 as it rotates into a more favourable location in the western hemisphere of the visible disc.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) is expected to continue to vary between Moderate and High levels initially due to the legacy of the high speed stream from CH66/+. A gradual day-on-day decrease in diurnal maxima is likely through the period, with more persistently background or Moderate levels expected by day 4 (04 Nov).

Electron fluence values remain just below the Active (greater than $1\text{e}8$ integrated pfu) threshold. There is a chance of reaching the Active threshold between days 1-3 (01-03 Nov) with the greatest likelihood of exceeding the Active threshold on day 1 (01 Nov). There is a gradual reduction in probabilities in the following days.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^8$	No	50	40	30	10
Very Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^9$	No	1	1	1	1

Figure 2: GOES16 >2MeV Electron Flux (above) and MOSWOC Fluence forecast (below)

